SEQUENCE LISTING

(1) GENERAL INFORMATION:

    (i) APPLICANT: Iverson, Brent
                Georgiou, George
                Chen, Gang
                Olsen, Mark J.
                Daugherty, Patrick S.

    (ii) TITLE OF INVENTION: Directed Evolution of Enzymes and
           Antibodies

   (iii) NUMBER OF SEQUENCES: 53

    (iv) CORRESPONDENCE ADDRESS:
        (A) ADDRESSEE: ARNOLD, WHITE AND DURKEE
        (B) STREET: P.O. Box 4433
        (C) CITY: Houston
        (D) STATE: Texas
        (E) COUNTRY: USA
        (F) ZIP: 77210-4433

    (v) COMPUTER READABLE FORM:
        (A) MEDIUM TYPE: Floppy disk
        (B) COMPUTER: IBM PC compatible
        (C) OPERATING SYSTEM: PC-DOS/MS-DOS
        (D) SOFTWARE: PatentIn Release #1.0, Version #1.30

    (vi) CURRENT APPLICATION DATA:
        (A) APPLICATION NUMBER: US UNKNOWN
        (B) FILING DATE: CONCURRENTLY HEREWITH
        (C) CLASSIFICATION: UNKNOWN

  (viii) ATTORNEY/AGENT INFORMATION:
        (A) NAME: Highlander, Steven L.
        (B) REGISTRATION NUMBER: 37,642
        (C) REFERENCE/DOCKET NUMBER: UTSB620

    (ix) TELECOMMUNICATION INFORMATION:
        (A) TELEPHONE: (512) 418-3000
        (B) TELEFAX: (713) 789-2679

(2) INFORMATION FOR SEQ ID NO:1:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 780 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (ix) FEATURE:
        (A) NAME/KEY: CDS
        (B) LOCATION: 1..780

```
GAA GTT CAA CTG CAA CAG TCT GGT CCT GAA TTG GTT AAA CCT GGC GCC       48
Glu Val Gln Leu Gln Gln Ser Gly Pro Glu Leu Val Lys Pro Gly Ala
1               5                   10                  15

TCT GTG CGC ATG TCC TGC AAA TCC TCA GGG TAC ATT TTC ACC GAC TTC       96
Ser Val Arg Met Ser Cys Lys Ser Ser Gly Tyr Ile Phe Thr Asp Phe
                20                  25                  30

TAC ATG AAT TGG GTT CGC CAG TCT CAT GGT AAG TCT CTA GAC TAC ATC      144
Tyr Met Asn Trp Val Arg Gln Ser His Gly Lys Ser Leu Asp Tyr Ile
            35                  40                  45

GGG TAC ATT TCC CCA TAC TCT GGG GTT ACC GGC TAC AAC CAG AAG TTT      192
Gly Tyr Ile Ser Pro Tyr Ser Gly Val Thr Gly Tyr Asn Gln Lys Phe
        50                  55                  60

AAA GGT AAG GCC ACC CTT ACT GTC GAC AAA TCT TCC TCA ACT GCT TAC      240
Lys Gly Lys Ala Thr Leu Thr Val Asp Lys Ser Ser Ser Thr Ala Tyr
65                  70                  75                  80

ATG GAG CTG CGT TCT TTG ACC TCT GAG GAC TCC GCG GTA TAC TAT TGC      288
Met Glu Leu Arg Ser Leu Thr Ser Glu Asp Ser Ala Val Tyr Tyr Cys
                85                  90                  95

GCC GGC TCC TCT GGT AAC AAA TGG GCC ATG GAT TAT TGG GGT CAT GGT      336
Ala Gly Ser Ser Gly Asn Lys Trp Ala Met Asp Tyr Trp Gly His Gly
                100                 105                 110

GCT AGC GTT ACT GTG AGC TCT GGT GGC GGT GGC TCG GGC GGT GGT GGG      384
Ala Ser Val Thr Val Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly
        115                 120                 125

TCG GGT GGC GGC GGA TCA GAC ATA GTA CTG ACC CAG TCT CCA GCT TCT      432
Ser Gly Gly Gly Gly Ser Asp Ile Val Leu Thr Gln Ser Pro Ala Ser
        130                 135                 140

TTG GCT GTG TCT CTA GGA CAA AGG GCC ACG ATA TCC TGC CGA TCC AGC      480
Leu Ala Val Ser Leu Gly Gln Arg Ala Thr Ile Ser Cys Arg Ser Ser
145                 150                 155                 160

CAA AGT CTC GTA CAT TCT AAT GGT AAT ACT TAT CTG AAC TGG TAC CAA      528
Gln Ser Leu Val His Ser Asn Gly Asn Thr Tyr Leu Asn Trp Tyr Gln
                165                 170                 175

CAG AAA CCA GGA CAG CCA CCC AAG CTT CTC ATC TAT AAG GTA TCC AAC      576
Gln Lys Pro Gly Gln Pro Pro Lys Leu Leu Ile Tyr Lys Val Ser Asn
                180                 185                 190

CGA TTC TCT GGA GTC CCT GCC AGG TTC AGT GGC AGT GGG TCT GAG TCA      624
Arg Phe Ser Gly Val Pro Ala Arg Phe Ser Gly Ser Gly Ser Glu Ser
        195                 200                 205

GAC TTC ACC CTC ACC ATC GAT CCT GTG GAG GAA GAT GAT GCT GCA ATA      672
Asp Phe Thr Leu Thr Ile Asp Pro Val Glu Glu Asp Asp Ala Ala Ile
        210                 215                 220
```

105

```
TAT TAC TGT AGC CAA ACT ACG CAT GTT CCA CCC ACG TTC GGC TCG GGG        720
Tyr Tyr Cys Ser Gln Thr Thr His Val Pro Pro Thr Phe Gly Ser Gly
225               230               235               240

ACC AAG CTG GAG CTG AAA CGT GCT AGC CAG CCA GAA CTC GCC CCG GAA        768
Thr Lys Leu Glu Leu Lys Arg Ala Ser Gln Pro Glu Leu Ala Pro Glu
            245               250               255

GAC CCC GAG GAC                                                        780
Asp Pro Glu Asp
            260
```

(2) INFORMATION FOR SEQ ID NO:2:

      (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 260 amino acids
        (B) TYPE: amino acid
        (D) TOPOLOGY: linear

      (ii) MOLECULE TYPE: protein

      (xi) SEQUENCE DESCRIPTION: SEQ ID NO:2:

```
Glu Val Gln Leu Gln Gln Ser Gly Pro Glu Leu Val Lys Pro Gly Ala
1               5               10              15

Ser Val Arg Met Ser Cys Lys Ser Ser Gly Tyr Ile Phe Thr Asp Phe
            20              25              30

Tyr Met Asn Trp Val Arg Gln Ser His Gly Lys Ser Leu Asp Tyr Ile
        35              40              45

Gly Tyr Ile Ser Pro Tyr Ser Gly Val Thr Gly Tyr Asn Gln Lys Phe
    50              55              60

Lys Gly Lys Ala Thr Leu Thr Val Asp Lys Ser Ser Ser Thr Ala Tyr
65              70              75              80

Met Glu Leu Arg Ser Leu Thr Ser Glu Asp Ser Ala Val Tyr Tyr Cys
            85              90              95

Ala Gly Ser Ser Gly Asn Lys Trp Ala Met Asp Tyr Trp Gly His Gly
            100             105             110

Ala Ser Val Thr Val Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly
        115             120             125

Ser Gly Gly Gly Gly Ser Asp Ile Val Leu Thr Gln Ser Pro Ala Ser
    130             135             140

Leu Ala Val Ser Leu Gly Gln Arg Ala Thr Ile Ser Cys Arg Ser Ser
145             150             155             160

Gln Ser Leu Val His Ser Asn Gly Asn Thr Tyr Leu Asn Trp Tyr Gln
            165             170             175

Gln Lys Pro Gly Gln Pro Pro Lys Leu Leu Ile Tyr Lys Val Ser Asn
        180             185             190
```

```
Arg Phe Ser Gly Val Pro Ala Arg Phe Ser Gly Ser Gly Ser Glu Ser
        195             200             205

Asp Phe Thr Leu Thr Ile Asp Pro Val Glu Glu Asp Asp Ala Ala Ile
    210             215             220

Tyr Tyr Cys Ser Gln Thr Thr His Val Pro Pro Thr Phe Gly Ser Gly
225             230             235             240

Thr Lys Leu Glu Leu Lys Arg Ala Ser Gln Pro Glu Leu Ala Pro Glu
            245             250             255

Asp Pro Glu Asp
        260
```

(2) INFORMATION FOR SEQ ID NO:3:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 18 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:3:

TGGACCAACA ACATCGGT   18

(2) INFORMATION FOR SEQ ID NO:4:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 26 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:4:

CCCATATCAC CAGCTCACCG TCTTTC   26

(2) INFORMATION FOR SEQ ID NO:5:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 32 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:5:

GACCCCGAGG ACTAACGTCT TCGAATAAAT AC   32

(2) INFORMATION FOR SEQ ID NO:6:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 25 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:6:

CCGAATTCGT TTGAACATGC CTAAC   25

(2) INFORMATION FOR SEQ ID NO:7:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 29 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:7:

CGGAATTCGT GCGCAACACG ATGAAGCTC   29

(2) INFORMATION FOR SEQ ID NO:8:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 31 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:8:

AGGGCATGCA AGGGCACCAA TAACTGCCTT A   31

(2) INFORMATION FOR SEQ ID NO:9:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 26 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:9:

TTGGCTGCAG TAATATATTG CAGCAT   26

(2) INFORMATION FOR SEQ ID NO:10:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 31 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:10:

TGCAATATAT TACTGCAGCC AAACTACGCA T   31

(2) INFORMATION FOR SEQ ID NO:11:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 30 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:11:

CGGCAGTTTC TGCAGATATA TTCGCAAGAT   30

(2) INFORMATION FOR SEQ ID NO:12:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 31 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:12:

CTTGCGAATA TATCTGCAGA AACTGCCGGA A   31

(2) INFORMATION FOR SEQ ID NO:13:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 40 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:13:

ACGCCACATC TTGCGAATAT ATCTGCAGAA ACTGCCGGAA   40

(2) INFORMATION FOR SEQ ID NO:14:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 18 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:14:

CAGGGTACAT TTTCACCG   18

(2) INFORMATION FOR SEQ ID NO:15:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 46 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (ix) FEATURE:
        (A) NAME/KEY: modified_base
        (B) LOCATION: one-of(13, 14, 22, 23, 28, 29)
        (D) OTHER INFORMATION: /note= "N = A, C, T or G"

    (ix) FEATURE:
        (A) NAME/KEY: modified_base
        (B) LOCATION: one-of(15, 24, 30)
        (D) OTHER INFORMATION: /note= "B = C, G or T"

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:15:

AACTGCAGCC AANNBACGCA TNNBCCANNB ACGTTCGGCT CGGGGA   46

(2) INFORMATION FOR SEQ ID NO:16:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 63 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (ix) FEATURE:
        (A) NAME/KEY: modified_base
        (B) LOCATION: one-of(31, 32, 34, 35, 37, 38, 40, 41)
        (D) OTHER INFORMATION: /note= "N = A, C, T or G"

    (ix) FEATURE:
        (A) NAME/KEY: modified_base
        (B) LOCATION: one-of(33, 36, 39, 42)
        (D) OTHER INFORMATION: /note= "S = C or G"

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:16:

GTATACTATT GCGCCGGCTC CTCTGGTAAC NNSNNSNNSN NSGATTATTG GGGTCATGGT   60

GCT   63

110

(2) INFORMATION FOR SEQ ID NO:17:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 30 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:17:

GTTACCAGAG GAGCCGGCGC AATAGTATAC   30

(2) INFORMATION FOR SEQ ID NO:18:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 36 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:18:

TACATTTTCA CCGACTTCAA TATGAATTGG GTTCGC   36

(2) INFORMATION FOR SEQ ID NO:19:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 36 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:19:

TACATTTTCA CCGACTTCTG CATGAATTGG GTTCGC   36

(2) INFORMATION FOR SEQ ID NO:20:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 36 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:20:

TACATTTTCA CCGACTTCTC TATGAATTGG GTTCGC   36

(2) INFORMATION FOR SEQ ID NO:21:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 36 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:21:

TACATTTTCA CCGACTTCGG GATGAATTGG GTTCGC   36

(2) INFORMATION FOR SEQ ID NO:22:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 36 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:22:

TACATTTTCA CCGACTTCTA AATGAATTGG GTTCGC   36

(2) INFORMATION FOR SEQ ID NO:23:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:23:

Ser Gln Thr Thr His Val Pro Pro Thr
1   5

(2) INFORMATION FOR SEQ ID NO:24:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:24:

Ser Gln Ala Thr His Met Pro Gly Thr
1   5

(2) INFORMATION FOR SEQ ID NO:25:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:25:

    Ser Gln Thr Thr His Phe Pro Val Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:26:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:26:

    Ser Gln Ala Thr His Tyr Pro Thr Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:27:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:27:

    Ser Gln Cys Thr His Trp Pro Val Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:28:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:28:

    Ser Gln Thr Thr His Val Pro Pro Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:29:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:29:

    Ser Gln Ala Thr His Tyr Pro Ser Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:30:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:30:

    Ser Gln Ala Thr His Ser Pro Ser Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:31:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:31:

    Ser Gln Val Thr His Gly Pro Arg Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:32:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:32:

    Ser Gln Gly Thr His Arg Pro Tyr Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:33:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:33:

    Ser Gln Ile Thr His Val Pro Lys Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:34:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:34:

    Ser Gln Leu Thr His Leu Pro Arg Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:35:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:35:

    Ser Gln Pro Thr His Val Pro Pro Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:36:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:36:

    Ser Gln Val Thr His Lys Pro Gly Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:37:

     (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:37:

    Ser Gln Leu Thr His Trp Pro Ser Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:38:

     (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:38:

    Ser Gln Leu Thr His Gly Pro Arg Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:39:

     (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:39:

    Ser Gln Leu Thr His Gly Pro Arg Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:40:

     (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:40:

    Ser Gln Glx Thr His Gly Pro Phe Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:41:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 10 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:41:

```
Ser Ser Gly Asn Lys Trp Ala Met Asp Tyr
1               5                   10
```

(2) INFORMATION FOR SEQ ID NO:42:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 10 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:42:

```
Ser Ser Gly Asn Tyr Arg Ala Leu Asp Tyr
1               5                   10
```

(2) INFORMATION FOR SEQ ID NO:43:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 10 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:43:

```
Ser Ser Gly Asn Arg Arg Ala Trp Asp Tyr
1               5                   10
```

(2) INFORMATION FOR SEQ ID NO:44:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 10 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:44:

```
Ser Ser Gly Asn Arg Arg Ala Leu Asp Tyr
1               5                   10
```

(2) INFORMATION FOR SEQ ID NO:45:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 10 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:45:

    Ser Ser Gly Asn Gly Arg Ala Trp Asp Tyr
    1   5   10

(2) INFORMATION FOR SEQ ID NO:46:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 10 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:46:

    Ser Ser Gly Asn Ile Ser Ala Leu Asp Tyr
    1   5   10

(2) INFORMATION FOR SEQ ID NO:47:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 10 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:47:

    Ser Ser Gly Asn Gln Arg Lys Met Asp Tyr
    1   5   10

(2) INFORMATION FOR SEQ ID NO:48:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:48:

    Ser Gln Thr Thr His Val Pro Pro Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:49:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:49:

    Ser Gln Val Thr His Arg Pro Leu Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:50:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:50:

    Ser Gln Val Thr His Asp Pro Gly Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:51:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:51:

    Ser Gln Val Thr His Cys Pro Ser Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:52:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:52:

    Ser Gln Val Thr His Trp Pro Pro Thr
    1   5

(2) INFORMATION FOR SEQ ID NO:53:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 9 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS:
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:53:

Ser Gln Val Thr His Tyr Pro Val Thr
1   5